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Australian Fine Art as an Alternative Investment

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In this study, 35,805 paintings by forty-five leading Australian artists sold at auction over the period 1973-2003 are used to construct individual hedonic price indices. The attributes included in each artist's hedonic regression model include the size and medium of the painting and the auction house and year in which the painting was sold. The indexes show that average annual returns across all artists range between four and fifteen percent and with a mean of eight percent, with the highest returns for works by Brett Whiteley, Jeffrey Smart, Cecil Brack and Margaret Olley. Risk-adjusted returns are generally lower, with reward-to-volatility and reward-to-variability ratios averaging 1.5 percent and 5.8 percent, respectively. The portfolio betas for individual artistic work average 0.41. The hedonic regression models also capture the willingness to pay for perceived attributes in the artwork, and these shows that works executed in oils and gouache, and those auctioned by Deutscher-Menzies, Sotheby's and Christies are generally associated with higher prices.

I. INTRODUCTION

With the end of the long bull market in equity, and now with falling property values, many international investors are turning to art (paintings, sculpture, ceramics and prints, along with collectibles such as coins, stamps, antiques and furniture) as an alternative investment. In Australia too there is burgeoning interest in art and art investment, particularly the work of Australian artists. Of course, Australia already has a long history of world-renowned nineteenth and twentieth century artists, including Frederick McCubbin, Arthur Streeton, Tom Roberts and Arthur Boyd. But just in the last few decades many modern and contemporary painters like Charles Blackman, Brett Whiteley, David Boyd, Ray Crooke and John Olsen have produced internationally reputable works and thereby raised public awareness of art as a potential investment opportunity. And in common with their predecessors, the works of many of` these more recent Australian artists have also realised high returns.

For example, in 2003 David Boyd's brightly coloured *Children Flying Kites* commanded a soaring price of $35,000 when the original estimate was just $12,000 to $18,000 and a large painting by John Olsen bought for $138,000 in 1999 was sold for $245,700. In 2004 a

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painting of Sydney Harbour by Brett Whiteley set a $2 million record price for modern Australian art and an explosive atmospheric painting by contemporary artist Tim Storrier sold for a personal best of $165,000. Most recently, Rover Thomas's *Uluru (Ayers Rock)* is expected to break the $1 million barrier for Aboriginal art this July, surpassing his own record of $778,750 for *All That Big Rain Coming From Top Side* in 2001. Local fine-art auction houses are struggling to keep up with the increased demand for Australian paintings, especially if the artists are included among the fifty most collectable by the Australian Art Collector magazine. As a consequence, Australia's art auction houses are expected to set a new sales record of $100 million in 2004, up from $92 million in 2003 and more than four times the turnover generated a decade earlier.

One patently useful source of information for collectors, investors, galleries, auction houses and museums interested in Australian art are indexes of market price movements. Such indexes allow not only the assessment of movements in art prices and returns over time, and thereby a means to compare the performance of art portfolios with other financial and non-financial assets, but also permit the comparison of returns by individual artists for the purposes of investment selection. They are also a potentially useful input in asset pricing and risk management models. Unfortunately, there are no known price indices of artistic work for Australian artists. This is a clear omission in the economics of art literature. For example, Buelens and Ginsburgh (1993) calculated price indices for English and Dutch painters, Agnello and Pierce (1996) created indices for leading American artists, while Mok et al. (1993), Candela and Scorcu (1997) and Rennboog and Van Houtte (2002) have produced price indices for Chinese, Italian and Belgian artists, respectively.

The purpose of this paper is to fill this gap in the literature by investigating the risk, return and asset pricing for Australian artists by creating market price indexes. The indexes are derived from hedonic pricing equations capturing the characteristics of artwork by forty-five well-known Australian artists publicly auctioned during the period 1973 to 2003. The paper itself is organised as follows. Section II briefly surveys the literature concerning art as an investment. Section III outlines the empirical methodology, while Section IV provides a description of the data employed. The empirical results are dealt with in Section V. The paper ends with some concluding remarks in the final section.

II. ART AS AN INVESTMENT

It goes without saying that art markets differ from financial markets. Art works are not very liquid assets, almost never divisible, transaction costs are high, and there are lengthy delays between the decision to sell and actual sale. Investing in art typically requires substantial knowledge of art and the art world, and a large amount of capital to acquire the work of well-known artists. The market is also highly segmented and dominated by a few large auction houses, and risk is pervasive, deriving from both the physical risks of fire and theft and the possibility of reattribution to a different artist. And while auction prices represent, in part, a consensus opinion on the value of art works, values in turn are determined by a complex and subjective set of beliefs based on past, present and future prices, individual tastes and changing fashion.

In sharp contrast, most financial assets are almost always liquid, readily diversifiable and can be selected on the basis of a relatively small set of objective criteria. Such markets are characterised by a large number of buyers and sellers, transaction costs are low, and trades in near identical assets are repeated millions of times daily in hundreds of competing markets and exchanges. Nevertheless, art has been traded on organised markets for some time, with the organisation of the global art market much the same as it was in the 17th Century, and the place attributed to an artist by aesthetic judgement depends more or less upon the prices set in these markets (Gérard-Varet, 1995). While this implies that at least some tools of orthodox financial analysis can, and frequently have, been applied to art markets, there is also the necessity to clearly identify the distinguishing characteristics of these markets so that their findings can be examined in an appropriate context.

One major distinguishing feature of art markets is that the art objects themselves are created by individuals, and are for the most part produced as differentiated objects. Accordingly, and in principle, there is only one unique piece of original work: an extreme case of a heterogeneous commodity. However, heterogeneity does not imply singularity (Chanel et al. 1994) since some substitutability remains among the work of a single artist, or among the works of artists within and across schools. Worthington and Higgs (2003), for example, have examined the short and long-run interrelationships between major painting markets, including Contemporary Masters, French Impressionists, Modern European, Old Masters and Surrealists. Likewise, there are thought to be strong relationships between art markets and financial markets (including stocks, bonds and property), with Chanel (1995), Ginsburgh and Jeanfils (1995) and Czujack et al. (1996) using cointegration techniques to explore this dimension of art research. Nonetheless, as the creative outpouring of a single artist (or group of artists), the supply of artwork is nonaugmentable, comprised as it is of the works of deceased artists and outmoded or outdated schools.

These particular characteristics manifest themselves most abundantly in the risks associated with art investment. Attribution remains a perennial challenge, as does the problem with fakes and forgeries. An example in the first instance is Rubens' *Daniel in the Lion's Den*. Auctioned in 1882 for £1,680 by Christies London it was resold in 1885 for £2,520. However in 1963, having been attributed in the meantime to fellow Flemish Baroque Era painter Jordaens, it was auctioned for a mere £500, but in 1965, now acknowledged as a school piece by Rubens, it was acquired by the Metropolitan Museum of Art in New York for £178,600 (Frey and Pommerehne, 1989). In the second instance it has, for example, been claimed there are 8,000 paintings by the French Realist Corot in the United States alone: an astonishing number considering there are only 2,000 authenticated works by that master. The numbers of van Dyck and Utrillo works sold are also thought to greatly exceed those that are authentic (Frey and Pommerehne, 1989).

Unfortunately, though the technical means of detecting fakes and forgeries has improved in recent years, transactions involving these works remain in the auction samples most often used to calculate the risk and return of art investment. Moreover, in addition to these financial risks arising from price uncertainty, there are purely material risks associated with the unique physical nature of art works. Paintings may be destroyed by fire, damaged during war, or stolen. Of course, while many material risks can be insured against, insurance costs as a percentage of appraised value are relatively high (up to one percent per annum), and for the most part unknown.

Similarly, substantial costs arise over time with maintenance and the restoration of art works, and these are seldom recognised in return calculations. It is also difficult to take into account the taxes due when transacting and holding an art object, though in many countries investment in art is a means of escaping or lowering the tax burden (Frey and Eichenberger, 1995a; 1995b). Moreover, transaction costs involved in sales through auction houses (fees, handling costs and insurance) vary significantly between countries, periods, auction houses, and individual transactions. Auction fees range from ten to thirty percent when both buying and selling, and this further complicates analyses of rates of return. Irregardless, a voluminous literature has arisen calculating the returns on art investment. Starting with Baumol (1986), these include studies by Frey and Pommerehne (1989), Goetzmann (1993), Chanel et al. (1994), Candela and Scorcu (1997), Pesando and Shum (1999) and Worthington and Higgs

(2004). But for the most part "his [Baumol's] results are here to stay: the (financial) rate of return on paintings is lower than for investment in financial assets (given higher risks in the former market) because paintings also yield a psychic return from owning and viewing the paintings" (Frey and Eichenberger, 1995b: 529).

Perhaps the main distinguishing feature between art markets and financial markets is then that the expected return from art investment consists not only of price gains but also the aforementioned psychic return of art works: through their aesthetic qualities, possibly through their social characteristics, and in the case of pieces acquired by museums for their cultural significance, even public-good attributes. Changing fashions and tastes can thus explain at least some of the extreme volatility in the prices and returns of art. For instance, at the turn of the 20th Century, Scottish industrialists were prepared to pay considerable sums for works by 19th Century European artists like Israëls or Maris. But tastes changed in just a few decades. As an example, in 1910 Maris' *Entrance to the Zuiderzee* made £3,150 at auction, and £2,887 in 1924, but eight years later it fetched no more than £75 (Fase, 1996).

Likewise, Hals' *Man in Black* was auctioned in 1885 for a little more than £5 at Christie's in London, and in 1913 reached £9,000 at Sotheby's (Frey and Pommerehne, 1989). More recently, Picasso's *La Lecture* was bought in (i.e. failed to sell) at US$4.8 million in 1996 after having sold for US$6.3 million in 1989. Almost without exception, studies of art investment have been unable to quantify these psychic returns associated with art as a consumption good and add them to the understated financial returns from art as an investment good. Recognising art as a consumption good goes far in explaining the segmentation that characterises most art markets, and in part accounts for the presence of behavioural anomalies less well-known in modern financial markets.

For instance, market segmentation, and the concomitant propensity for anomalies, is likely to occur among art investors. Many private collectors are not profit orientated and are particularly prone to the anomalies that arise from 'endowment effects' (an art object owned is valued higher than one that is not), 'opportunity cost effects' (many collectors isolate themselves from considering the returns of alternative uses of funds) and a 'sunk cost effect' (past efforts to build a particular genre or school of art are important) (Frey and Eichenberger, 1995a; 1995b). Private collectors may also be subject to a 'bequest effect' whereby art objects given to their beneficiaries carry a psychic return over and above their notional value. Similarly, Felton (1998: 286) observes that the analysis of auction data is "…complicated by the fact that both professional and amateur bidders, who may have different risk aversions,

[are] involved in the bidding [and] the amount of risk aversion seem[s] to depend on the unit sold and the existence of a penalty, not on the attribute of the subject". These conditions are rarely found in modern financial markets.

At the least, it could be expected that corporate collectors undertake their investments solely on the basis of financial returns. Rarely, however, is the means of collection open to more than a small number of persons within a firm and even then is primarily used for consumption purposes. Lastly, public museums are important buyers of art. Once art works are acquired it is rare for these organisations to be either willing or able to dispose of works in the market, nor to change the speciality of their collection. Many specific art works are also obtained with hypothecated grants from governments or fundraising activities and these cannot usually be used for other purposes. For these reasons it is argued that sellers to museums enjoy systematically higher rates of return. Frey and Eichenberger (1995a: 215) suggest *inter alia* that museums are also likely to be active in particular genres of art that do not attract individual or corporate collectors. These particularly include religious scenes depicting the torture of saints and still lives featuring game.

Frey and Eichenberger (1995a; 1995b) used this evidence to argue that the behavioural characteristics of art market participants vary dramatically between 'pure speculators', whose activity in art investment markets in largely associated with changes in financial risk, and 'pure collectors' who are more attune to the psychic returns of art and less-sensitive to notions of financial risk. In the extreme, the more 'pure collectors' there are in a market, the lower is the financial return in equilibrium; the major part of investment return is made up of psychic benefits. An emerging literature has examined this and other efficiency aspects of art markets, including Coffman (1991), Louargand and McDaniel (1991), Pesando (1993) and Goetzmann (1995).

At first impression, art markets appear to have little in common with financial markets. Most art markets are characterised by product heterogeneity, illiquidity, market segmentation, information asymmetries, behavioural abnormalities, and almost monopolistic price setting. And there is no doubting the fact that a substantial component of the return from art investment is derived not from financial returns, rather its intrinsic aesthetic qualities. However, in recent years it has been widely accepted that art markets have moved closer to the ideals set by financial markets. Turnover, for example, has increased dramatically among auction houses and the larger proportions of transactions are pursued in these as against dealers. Likewise, information on alternative art investments is now more accessible through the attention of the media, and the publishing and dissemination of auction catalogues and price indexes. Finally, it is generally accepted that there are many more buyers and sellers active in these markets than in the past.

III. EMPIRICAL METHODOLOGY

Three principal methods have been used for calculating art indices: (i) the naïve (or arithmetic) art index method; (ii) the repeat-sales index method; and (iii) the hedonic price index method. To start with, the calculation of naïve art indices is comparable to the calculation of a Consumer Price Index since a fixed basket of representative paintings is specified for the base year. Experts revalue the paintings in the basket whenever there is an event – such as an auction, major exhibition or publication – that is likely to impact on market prices. Since the quality of the artworks included in the basket remains unchanged, the calculation of a mean or median price (the latter being less affected by outliers and infrequent trading) allows a simple arithmetic comparison with the base year. This method also permits the creation of new baskets by artist and movement and a variation allows the substitution of works not consistently auctioned with works of a similar size and quality by the same artist. A drawback is that prices often reflect the subjective opinion of the experts involved, which may or may not be based on actual sales. Art Market Research (2004) indexes are commercially available exemplars of this method, and Worthington and Higgs (2003; 2004) have used these to analyse art price movements and return relationships.

The second approach used to calculate art price indices is the repeat-sales index method. Here the purchasing and selling prices of individual paintings are used to estimate the changes in the value of a painting over a period of time. That is, sales data are only used if a painting is sold more than once, the focus being on the price movements of this one work. After calculating the return for each pair of sales, regression techniques are then used to estimate the average return across artists, schools and periods. The main benefit of using the repeat-sales index method is that the index is based on the price relatives of the same painting, thereby controlling directly for differences in quality.

The main disadvantage is that the index can only be calculated using multiple sales, and since collector's tastes change slowly, along with the pool of potential collectors, resale of any given painting within a short period of time is unlikely. As a result, repeat-sales indexes are often constructed using samples over several decades, even centuries. High transaction fees, restrictions on arbitrage (short selling is impossible) and information asymmetry between traders also serve to reduce the number of resales. As an example, in Locatelli Biey and Zanolla's (1999) sample of 200,000 sales over the period 1987-1995, just 1,669 were resales. All the same, Anderson (1974), Goetzmann (1993), Chanel et al. (1994), Gerard-Varet (1995) and Mei and Mosses (2001) have employed this method of calculating art price indexes.

The final approach is the hedonic price index method. In this approach, all sales (including repeat sales) are considered as single sales for which the objective features are recorded (i.e. name of the painter, size of painting, medium of execution, etc.). Combining all sales allows the implicit (or shadow) prices for these characteristics to be estimated separately from a characteristic-free price including only the effects of time and random error. Put simply, the hedonic regression method 'strips' observable 'qualities' from the prices of paintings to retain an index reflecting the price of some 'standard' work. Depending on the sample, the standard painting could relate to work by a single artist or to a grouping of artists by nationality, movement or period. A clear advantage is that all auction data is used. There is also no need to undertake the difficult task of identifying resales in large datasets. The main disadvantage is that often only a few characteristics of each painting are gathered together in any given dataset (usually auction records). Buelens and Ginsburgh (1993), de la Barre *et al.* (1994), Chanel (1995) and Agnello and Pierce (1996) have used the hedonic price index method to estimate art price indices, with Chanel (1995) concluding that while the market wide effect was unbiased in both the repeat-sales and hedonic price index methods, the variance of the coefficient estimates for the latter were much smaller.

The approach selected for the current analysis is the hedonic price index method. Assuming the availability of comprehensive data, the hedonic price index method's main strengths are that it estimates values based on actual auction sales, and as a collateral outcome, captures the willingness to pay for perceived differences in the attributes of the artwork included in the index. The hedonic price equation is written as:

$$\ln p_{kt} = f(X_{1kt},...,X_{mkt},...,X_{Mkt}) + g(t) + \varepsilon_{kt} \tag{1}$$

where $\ln p_{kt}$ is the natural logarithm of the price of painting k ($k = 1,...,K$) sold in year t ($t = 1,...,T$), X_{mkt} is the measurable characteristics m ($m = 1,...,M$) of painting k at time t, $g(t)$ is a function of time, and the error term $\varepsilon \sim N(0, \Sigma_k \otimes I_T)$. The measurable characteristics of the paintings for each artist comprise the physical characteristics of the work and the characteristics of the auction at which the sale took place. The regression equation is then specified as:

$$\ln p_{kt} = \sum_{m=1}^{M} \alpha_m X_{mkt} + \sum_{t=1}^{T} \beta_t Z_t + \varepsilon_{kt} \qquad (2)$$

where α_m are parameter estimates of the implicit prices of the specified art characteristics, Z_t is a dummy variable which takes the value of one for a sale occurring in year t and zero elsewhere, β_t is a parameter estimate, $e^{\beta t}$ gives the art price index and all other variables are as previously defined. Separate regression equations are specified for each artist.

The data used comprises 35,805 sales transactions of artworks by forty-five leading Australian artists. Information on sales is obtained from Australian Art Auction Records (2003) and spans the period March 1973 to June 2003. The selection of artists to be included in the analysis is, of course, highly subjective and was arrived at after discussion with various art auctioneers, curators and dealers on those artists whose works were most sought after and frequently sold at auction in the past thirty years. Its construction is also reflective, in so far is possible, of the widest number of periods, schools and genres in Australian art history and is purposively restricted to artists who lived most of their lifetime in Australia. A list of the artists is provided in Table 1.

The first set of information gathered is the price of each artwork for each artist. This comprises the dependent variable in the hedonic price regression. Each artwork included is sold exclusively at public auction and its value specified in Australian dollars. In the same manner as prices in financial markets (stock, bonds, bills, etc.), all prices are nominal and hence the price index calculated is in nominal terms. Importantly, it is not known whether there is potential systematic upward or downward bias in any price index calculated using this data. Since auction prices are the outcome of a competitive process it could be suggested that the prices used are lower than those from either expert valuations or those displayed in art galleries. On the other hand, auction prices are argued to be artificially high as auction houses have financial overheads not shared by galleries, while large auction houses may also exercise market power to attract more valuable works. In this instance, the prices may be higher than those obtained from these other sources. However, since the true or intrinsic value is not observable, it is not possible to make a definitive statement on whether there is systematic under or overbidding in the Australian auction market at all times.

The next two sets of variables are considered to be major determinants of the price of an artist's work and are specified as explanatory variables in each hedonic pricing regression. The first set of explanatory variables relate to the physical characteristics of the work while the second set comprise its sale characteristics. Starting with the physical characteristics of the works, the first group comprises dummy variables identifying the medium used: namely, acrylic (*ACR*), charcoal (*CHA*), crayon (*CRA*), etching (*ETC*), the heavy, opaque watercolour paint known as gouache, (*GOU*), mixed media (*MIX*), oil (*OIL*), pastel (*PAS*), pencil (*PEN*) and watercolour (*WCO*). The reference category is all other mediums. Of the mediums used by artists in the sample, the largest numbers of works sold are oils (*OIL*), followed by watercolours (*WCO*), and finally etchings (*ETC*). Oil as a medium, though difficult to work, has excellent visual qualities and is not easily faded by natural light. It is therefore likely to fetch higher prices at auction. Modern alternatives, including acrylic and gouache, also command high prices. However, a variety of other potentially valuable media are found in most fine-art collections. Australian landscape artists, for instance, often favour watercolours.

The second group of physical characteristic are the dimensions of the painted work as represented by surface area (*ARE*) in square metres (m^2) and surface area squared (*ASQ*) as the non-linear component. A positive relationship is generally hypothesised when price is regressed against *ARE,* although it is difficult for all but the largest public galleries to display very large works. On this basis, the expected sign on the coefficient for *ASQ* is thought to be negative (Agnello and Pierce 1996). Of course, there are any number of other physical characteristics that could be included if data were available. These include the painting's genre, providence, the date it was completed, the presence of the artist's signature and so on.

The second set of explanatory variables incorporate the sales characteristics of the work. The first of these are dummy variables identifying in which of Australia's three largest auction houses the sale took place: that is, Christies (*CHR*), Deutscher-Menzies (*DEU*) and Sotheby's (*SOT*). The reference category is all other auction houses. During the sample period, the largest number of works was sold through Christies (*CHR*) followed by Sotheby's (*SOT*). In the absence of transaction costs, the law of one price dictates that no significant price difference should exist for paintings of a similar quality. However, Pesando (1993), de la Barre *et al*. (1994) and Renneboog and Van Houtte (2002), amongst others, have found that Christies and Sotheby's systematically obtain higher hammer prices through their reputation and market power. The second group of sales characteristics identifies the year when the work is sold. This consists of thirty yearly dummy variables with 1973 as the reference category. Accordingly, 1973 provides the base period for the index.

IV. PROPERTIES OF THE DATA

Selected descriptive statistics of artwork prices as the dependent variable for each artist's hedonic regression equation are provided in Table 1. Samples means and standard deviations are presented, along with measures of skewness and kurtosis, the Jarque-Bera statistic and its *p*-value, and the number of sold works included in the sample. Turning first to the prices of artworks by artist, average prices range from \$796 for paintings by Boyd (Jamie) (*BYJ*) to \$55,245 for works by McCubbin (*MCC*). Other artist's with high valued works are Russell (*RUS*), Smart (*SMA*) and Brack (*BRA*) with means of \$45,167, \$36,544 and \$35,010, respectively. The lowest prices are paid for works by Hart (*HAR*), Hodgkinson (*HOD*) and Fizelle (*FIZ*) with average prices of \$1,442, \$1,526 and \$1,564, respectively. The standard deviations of art prices by artist range from \$872 to \$171,014. On this basis, works by Boyd (Jamie) (*BYJ*), Hodgkinson (*HOD*), Hart (*HAR*) and Boyd (David) (*BYD*) are the least volatile with standard deviations of \$872, \$2,509, \$2,674 and \$2,772, respectively, whereas works by McCubbin (*MCC*), Drysdale (*DRY*), Russell (*RUS*) and Whiteley (*WHI*) are the most volatile with standard deviations of \$171,014, \$115,731, \$100,079 and \$82,465, respectively.

<TABLE 1 HERE>

By and large, the distributional properties of the artwork prices by individual artist appear non-normal. The measures of skewness are all positive and range from 1.25 (*NAM*) to 18.23 (*HAR*). Since the asymptotic sampling distribution of skewness is normal with a mean of 0 and standard deviation of $\sqrt{6/n}$ where n is the sample size, and given that the smallest sample size is 99, the standard deviation under the null hypothesis of normality is 0.2462. All estimates of skewness are then significant at the 0.05 level of significance or lower, suggesting a long right tail of high prices for work by all artists. The kurtosis, or degree of excess, for all artists is also larger than 3, ranging from 5.05 (*NAM*) to 517.25 (*HAR*), therefore all of these series can be represented by a leptokurtic (or fat-tailed) distribution. Given the sampling distribution of kurtosis is normal with a mean of 0 and standard deviation of $\sqrt{24/n}$ = 0.4923 (for the smallest sample size of 99), then all estimates are once again statistically significant at any conventional level. The calculated Jarque-Bera statistics and corresponding *p*-values in Table 1 are used to test the null hypothesis that the distribution for the art prices is normally distributed. All *p*-values are less than the 0.01 level of significance indicating that the prices for all artists are not well approximated by a normal distribution.

Table 1 also includes the descriptive measures of each artist's work categorised according to the media used. Of these, oils (*OIL*) watercolours (*WCO*) and etchings (*ETC*) are the most common medium sold, while crayons (*CRA*) and acrylics (*ACR*) are the least common.

Descriptive measures of the sales by auction house are also presented. More works in the sample are sold by Christies (*CHR*) then Sotheby's (*SOT*). However, the distribution of all physical and sales characteristics varies dramatically by artist. For example, sold work by Nolan (*NOL*), Fullbrook (*FUL*) and Bunny (*BUN*) are almost exclusively oil (*OIL*), while Namatjira's (*NAM*) sold works are primarily watercolours (*WCO*). Relatively few sold works for many artists are in acrylic (*ACR*), crayon (*CRA*) or charcoal (*CHA*). Similarly, the distribution of sold works by auction house also varies across the artists. For example, 54 percent of Whiteley's (*WHI*) work was sold at Christies (*CHR*), 32 percent of Brack's (*BRA*) at Deutscher-Menzies (*DEU*) and 54 percent of Fullbrook's at Sotheby's (*SOT*). This contrasts markedly to averages across the sample, with 20 percent of work sold at Christies (*CHR*), 5 percent at Deutscher-Menzies (*DEU*) and 19 percent at Sotheby's (*SOT*).

V. EMPIRICAL RESULTS

The estimated coefficients of the hedonic pricing regression models for each of the forty-five Australian artists are presented in Table 2. Because the null hypotheses of no heteroskedasticity in the least squares residuals in all regressions were initially rejected using White's (1980) test, the standard errors and *p*-values incorporate White's (1980) corrections for an unknown form of heteroskedasticity. Also included are the percentage effects of a unit change for the zero-one dummy variables and the elasticity (at the means) for the continuous variables. All of the estimated models are highly significant, with likelihood ratio tests (not shown) of the hypotheses that the slope coefficients are zero rejected at the 1 percent level. Adjusted R^2 range between 0.547 (*FIZ*) and 0.889 (*OLL*) and are reasonably high for what is basically cross-sectional data. The estimated parameters also appear sensible in terms of both the precision of the estimates and the signs on the coefficients. To test for multicollinearity, variance inflation factors are calculated (not shown). Since none of the variance inflation factors for any of the artists are significantly greater than ten, this suggests that multicollinearity, while present, is not too serious a problem. For the purposes of brevity, the estimated coefficients, standard errors, *p*-values and percentage changes for the thirty index parameters for each artist are not presented.

<TABLE 2 HERE>

The physical characteristics in each artist's regression model comprise the medium of execution (i.e. oil, acrylic, charcoal, crayon, gouache, etc.) and the size of the work. To start with, and as hypothesised, the percentage changes in value in Table 2 indicate that works executed in oil (*OIL*) and gouache (*GOU*) command higher prices, with average percentage increases over each artist's standard work of 6.799 and 6.733 percent, respectively. Of the forty-four artists in the sample with at least some oil works, all but one have significant and positive increases in value relative to other work, while twenty-eight of the thirty artists with gouache works have significant and positive increases with this particular media. However, the percentage increases in value for individual artists vary widely. For example, with oils the increase in values ranges from as little as 1.188 percent (*FIZ*) to more than 21.700 percent (*BRA*) and for gouache from just 0.684 percent (*OLL*) to 68.217 percent (*SMI*).

By comparison, media such as etchings (*ETC*), crayon (*CRA*) and charcoal (*CHA*) are associated with respective average percentage increases across the sample of just 1.105, 3.020 and 1.787 percent implying these media are generally more affordable, regardless of all other characteristics, while mixed media (*MIX*), watercolours (*WCO*) and pastels (*PAS*) have average price increases across the sample of 3.466, 3.346 and 3.646 percent, respectively. Unfortunately, it is difficult to compare these findings because other studies are often limited to periods or movements when fewer media are generally known (de la Barre et al. 1994; Renneboog and Van Houtte 2002) or to a single medium (Candela and Scorcu 1997; Pesando and Shum 1999). That said, Agnello and Pierce (1996) found a 156 percent increase in prices for oil works as compared to all other media (watercolour, gouache, ink, pencil, pastel, etc.).

The remaining physical characteristics included in the regression model concern the size of the work. These are the area of the work in square metres (*ARE*) and its nonlinear component, area squared (*ASQ*). The generally positive and significant signs of the area coefficients and the negative and significant signs of its squared term indicate that Australian art prices tend first to increase with size, then decrease as the paintings become too large and difficult to house. Across the sample, a one percent increase in surface area is associated with a 0.206 percent increase in price, while on average the price-maximising size is 4.08 square metres. By comparison, Agnello and Pierce (1996) found the price-maximising size for American artists' work to be 6.53 square metres while de la Barre et al. (1994) calculated this optimal size to be 5.89 square metres for Old Masters and 1.70 square metres for Modern and Contemporary European works. Redundant variables tests of the null hypotheses of the joint insignificance of the characteristics of the work for each artist are rejected at the .10 level or lower.

The final set of variables relates to the sale characteristics of the works. The sales characteristics show that auctions at Sotheby's (*SOT*), Christies (*CHR*) and Deutscher-

Menzies (*DEU*) increase the average standard price by 1.759, 1.697 and 1.869 percent, respectively, over the remaining houses. Pesando (1993), de la Barre et al. (1994), Agnello and Pierce (1996) and Renneboog and Van Houtte (2002) also found that "…Sotherby's typically fetches higher prices than Christies, while both experience higher prices than all other houses" (Agnello and Pierce 1996: 366). However, while variation in the prices obtained by the different auction houses are small, and certainly smaller than most other factors included in the model, care should still be taken in interpreting these differences as a violation of the law of one price. As an example, both Sotheby's and Christies usually attract more high valued artistic works and therefore some degree of simultaneity exists between price and auction house. Even among works by a single artist, those with anticipated higher values may be directed to leading auction houses, with lesser work appearing in other venues, including galleries and private dealers. De la Barre et al (1994: 165), for example, concluded "…the quality of a painting, not captured by our characteristics is partly picked up by the saleroom coefficients: a 'good' Picasso would go to Christies or Sotheby's New York, a less good one would be sold at Drouot's [a Paris-based auction house]…it is impossible to disentangle the two effects".

<TABLE 3 HERE>

Turning to investment risk and return, the index value for each year 1973-2003 for each artist is calculated as $100e^{\beta t}$ (not shown). Annual returns are then calculated such that the return for artist *i* is represented by the continuously compounded return or log return of the price index at time *t* such that $\Delta p_{it} = \log(p_{it} / p_{it-1}) \times 100$ where Δp_{it} denotes the rate of change of p_{it}. Table 3 presents the arithmetic mean and standard deviation (risk) of annual returns for the forty-five Australian artists over the period 1973 to 2003. Ranks for the mean return and standard deviation of returns are included in descending and ascending order, respectively.

Also included in Table 3 are two external risk-adjusted portfolio performance measures. The Sharpe ratio (also known as the reward-to-volatility ratio) indicates the excess return per unit of risk and is calculated by dividing the return in excess of the risk-free rate by the standard deviation of returns. The proxy used for the risk-free rate is the exponentially smoothed average fitted yield for 3-year Commonwealth Treasury bonds during the sample period (5 percent). In the current context, the Sharpe ratio is the most appropriate performance measure for an investor whose portfolio is composed wholly of a given artist's work.

The Treynor ratio (sometimes called the reward-to-variability ratio) is identical to the Sharpe ratio except that total risk (standard deviation) is replaced with systematic (market) risk or beta. This ratio may be a better benchmark of performance for investors who do not invest exclusively in art, but rather consider its diversification potential. Accordingly, the beta of each artist's portfolio (shown in Table 3 and ranked in descending order) is calculated with respect to an equity market portfolio. The All Ordinaries index is specified. This is a broad market-weighted price index which tracks movements on the Australian Stock Exchange and currently accounts for more than ninety percent of market capitalisation. Since higher Sharpe and Treynor ratios represent better performance, the artistic portfolios are ranked in descending order.

In terms of returns, mean returns for the individual artists range between 3.70 percent for works by Friend to 14.70 percent for those by Whitelely. Annual returns across all artists average 8.23 percent, as compared to mean returns on the All Ordinaries of 7.00 percent over this same period. Other artists with relatively high returns include Smart, Brack, Olley, Smith, Proctor and Olsen, with relatively low returns for Withers, Gruner, Dargie, Crooke, Nolan, Lindsay and Boyd (Arthur). The standard deviation (risk) of returns ranges between 0.189 (Hart) to 1.933 (Roberts) with a mean of 0.449. By way of comparison, the standard deviation of returns on the All Ordinaries over this same period was 0.161. Risk is also relatively higher for works by Russell, Heysen (Nora), Fullbrook and Fairweather and relatively lower for works by Dickerson, Lindsay, Boyd (David) and Crooke.

For overall returns on Australian art, it would appear that the market has performed at a comparable level to other national markets. Renneboog and van Houtte (2002), for example, found Belgian average returns of 8.4 percent over the period 1970-1989 with a standard deviation of 19.4 percent, Agnello and Pierce (1996) estimated that the returns on American artists averaged 9.3 percent from 1971-1992, and Mei and Moses (2001) calculated average returns of 5.3 percent with a standard deviation of 9.3 percent, also on American auctions. Mean returns from other art studies include 1.6 percent (Frey and Pommerehne 1989), 6.8 percent (Gerard-Varet 1995) and 5.0 percent (Goetzmann 1996). Of course, the returns as calculated do not reflect the fact that a substantial component of the return from art investment is derived not from its financial returns, rather from its intrinsic aesthetic qualities. Equally, they also do not include the many and sizeable transaction and holding costs associated with art portfolios, the absence of which may serve to inflate financial returns.

Analysis of the risk-adjusted returns for each artist's portfolio of works provides further insights. Starting with the Sharpe ratio, artists ranked highly on the basis of returns per unit of (total) risk include Whiteley (0.345), Smart (0.211), Olley (0.210), Brack (0.155) and Proctor (0.172). The Sharpe index for the All Ordinaries over this same period is 0.124 while that for the average artist included in the sample is just 0.015. As shown, many artists have low Sharpe ratios (and rankings) suggesting that a policy of holding high return, high risk portfolios of a single artist's work in isolation may not be an appropriate investment strategy. As an alternative, the Treynor ratio show the returns per unit of (systematic) risk and thus yields useful insights on the benefit of holding Australian art as part of a diversified portfolio (though, of course, limited in this analysis to listed equity).

As shown in Table 3, the betas of most Australian artist's work are low (less than one), if not negative, indicating potential diversification benefits. For example, the negative betas calculated on art portfolios composed of works by Hodgkinson, Proctor, Gruner, Coburn and Williams indicate that their returns move contrary to returns on the Australian stock market. However, some art portfolios are substantially more risky (in terms of beta) than the market, and move in the same direction, including Russell, Smith, Boyd (Jamie), Preston and Fox. The average beta across the sample is 0.405 with 25 percent of artistic portfolios having a beta less than 0.075 and 25 percent greater than 0.566. By comparison, Chanel et al. (1994) calculated that national art betas ranged between 0.028 (London) and 0.368 (Tokyo), while Renneboog and van Houtte (2002) estimated movement betas with respect to a global stock index of -3.7, -2.9 and 0.8 for Impressionist, Luminist and Expressionist art, respectively.

The Treynor ratios for the forty-five artist portfolios in mean/beta-space are graphically represented in Figure 1. The figure includes the security market line constructed using the risk-free rate (intercept) and the return and beta (one) for the market portfolio (slope). Visual inspection indicates that few artist portfolios are correctly priced in relation to the security market line (that is, lying on the line) with most underpriced. That is, artist portfolios lying above the line indicate superior market risk-adjusted returns and a buy signal, while those lying below the line indicate inferior market risk-adjusted returns and a sell signal. Artists ranked highly on the basis of the Treynor index include Streeton, McCubbin, Whiteley, Long and Brack. A buy signal is indicated for these artists. Those ranked lowly with a consequent sell signal include Smart, Olsen, Fullbrook, Fairweather and Glover.

<FIGURE 1 HERE>

Of course, these buy-and-sell strategies must be qualified by the fact that they relate to historical information averaged over a thirty year investment horizon, not the immediate past, present or future. It should also be remembered that the Treynor ratio reflects only systematic (general or market) risk and thereby reflects the value of these assets within a diversified portfolio. The change in rankings of artists between the Sharpe and Treynor measures indicate that most art portfolios as analysed include much unsystematic (asset specific or nonmarket) risk when held in isolation. Nonetheless, while the rankings of artists on the Sharpe and Treynor criterion do vary, there is some deal of correspondence between them with the Spearman (rank) correlation coefficient signifying a significant and positive relationship (rho = 0.319, *p*-value = 0.033).

<FIGURE 2 HERE>

One final requirement is to examine the relationship between the returns and values of works included in each artistic portfolio. This follows the suggestion of Mei and Moses (2001) amongst others that bidders in art auctions are exposed to a 'winner's curse' so that the returns on expensive paintings tend to under perform the market as a whole: referred to as the 'masterpiece effect'. Figure 2 plots the returns and mean prices of paintings for each artist, with a linear trendline added as a simple means of evaluating the relationship between value and return. As shown, there is a small positive (1.03E-06) and significant (*p*-value = 0.019) relationship suggesting that returns increase with value, thereby supporting the absence of a 'masterpiece effect' effect. However, more complex analytical techniques in the manner of Mei and Moses (2001) may provide a very different conclusion.

VI. CONCLUDING REMARKS

This paper investigates risk, return and assets pricing for the works of forty-five well-known Australian artists during the period 1973 to 2003. The hedonic price method is used to construct yearly individual price indexes using data on 35,805 paintings sold at auction during this time. However, unlike most other work in this area which indicates that the returns to art investment are much less, and the risks much higher, than investment markets, the results show that return on a buy-and-hold strategy in the Australian art market are at least comparable to the stock market. While total risk is indeed greater than the stock market, the very low market risk found in almost all artistic portfolios is highly suggestive of the possible benefits of portfolio diversification through art investment.

That said, a number of artist's works offer superior market and non-market risk-adjusted performance over the sample period, above all Arthur Streeton, Frederick McCubbin, Brett Whiteley, Sydney Long, Cecil Brack, Frank Smart, Margaret Olley and Althea Proctor. One major qualification is that the analysis does not take into account the (sizeable) transaction costs incurred at the moment of sale nor the (equally ample) insurance and other costs associated with restoring, preserving and displaying art works. However, neither does it take into account the (equally substantial) aesthetic returns from owning and displaying fine art. The methodology employed in the paper also identifies factors associated with higher prices in the Australian art market. All other things being equal, larger sized works and those executed in oils or gouache, and those auctioned by Sotheby's or Christies are associated with higher prices. Conversely, smaller works, etchings, crayon or charcoal works, along with those auctioned by other auction houses, are associated with systematically lower prices.

There are many interesting opportunities to expand upon this work. One possibility would involve gathering additional information to be included in the hedonic pricing regression models. For example, the prices (and hence returns) on artists' work may also depend on the cumulative number of works auctioned, whether the artist is deceased or the age of the artist at the time of auction, genres of work, interactions between medium and size and so on. While these impacts are proxied to some extent by the variables included in the current analysis, a more defined specification would identify some determinants potentially obscured. There may also be opportunities to examine art markets along the lines of the market efficiency literature. One prospect is to examine the time-series behaviour of returns to examine whether the art market fully incorporates all historical market information (weak-form efficient).

Finally, the art works on which these indices are based may not reflect the market for Australian paintings as a whole: private transactions for example conducted through art galleries are ignored. Depending on the values found in galleries, indexes constructed using auction data may understate or overstate the true financial returns. There is also no recognition that different buyers in the market have differing preferences for art work: compare, for instance, works bought by public galleries to those purchased privately. For this reason, sellers of art to public collections are argued to enjoy systematically higher rates of return. Future work could take into account these subtleties.

REFERENCES

Agnello, R.J. and Pierce, R.K. (1996), 'Financial Returns, Price Determinants, and Genre Effects in American Art Investment', *Journal of Cultural Economics* **20**, 359-383.

Anderson, R.C. (1974), ‘Paintings as Investment’, *Economic Enquiry* **2**, 13-26.
Art Market Research (2004), <http://www.artmarketresearch.com/> Accessed June 2004.
Australian Art Auction Records Pty. Ltd. (2003), *Australian Art Auction Records, 1972-2003*, CD, Sydney.
Baumol, W.J., (1986), ‘Unnatural Value: Or Art Investment as a Floating Crap Game’, *American Economic Review* **76**, 10-14.
Buelens, N. and Ginsburgh, V. (1993), Revisiting Baumol’s ‘Art as a floating crap game’, *European Economic Review* **37**, 1351-1371.
Candela, G. and Scorcu, A.E. (1997), ‘A price index for art market auctions’, *Journal of Cultural Economics* **21**, 175-196.
Chanel, O. (1995), ‘Is Art Market Behaviour Predictable?’, *European Economic Review* **39**, 519-527.
Chanel, O. Gerard-Varet, L.A. and Ginsburgh, V. (1994), ‘Prices and Returns on Paintings: An Exercise on How to Price the Priceless’, *Geneva Papers on Risk and Insurance Theory* **19**, 7-21.
Coffman, R.B. (1991), ‘Art Investment and Asymmetrical Information’, *Journal of Cultural Economics* **15**, 83-94.
Czujack, C., R. Flores, and V. Ginsburgh, (1996), On long-run price comovements between paintings and prints, in: V.A. Ginsburgh and P.M. Menger, eds., *Economics of the Arts: Selected Essays* (Elsevier North-Holland, Amsterdam) 85–112.
de la Barre. M., Docclo, S. and Ginsburgh, V. (1994), ‘Returns of Impressionist, Modern and Contemporary European Paintings 1962-1991’, *Annales d’Economie et de Statistique* **35**, 143-181.
Fase, M.M. (1996), ‘Purchase of Art: Consumption and Investment’, *De Economis*, **144** 649-658.
Felton, M.V. (1998), ‘Review of: Economics of the Arts: Selected Essays’, *Journal of Economic Literature* **36**, 286-287.
Flores, R.G., Ginsburgh, V. and Jeanfils, P. (1999), ‘Long and Short Term Portfolio Choices of Paintings’, *Journal of Cultural Economics* **23**, 193-201.
Frey, B. and Pommerehne, W. (1989), ‘Art Investment: An Empirical Inquiry, *Southern Economic Journal* **56**, 396-407.
Frey, B.S. and Eichenberger, R. (1995a), ‘On the Return of Art Investment Return Analyses’, *Journal of Cultural Economics* **19**, 207-220.
Frey, B.S. and Eichenberger, R. (1995b), ‘On the Rate of Return in the Art Market: Survey and Evaluation’, *European Economic Review* **39**, 528-537.
Gerard-Varet, L.A. (1995), ‘On Pricing the Priceless: Comments on the Economics of the Visual Art Market’, *European Economic Review* **39**, 509-518.
Ginsburgh, V. and Jeanfils, P. (1995), ‘Long Term Comovements in International Markets for Paintings’, *European Economic Review* **39**, 538-548.
Goetzmann, W.N. (1993) Accounting for Taste: Art and the Finance Markets over Three Centuries, *American Economic Review* **83**, 1370-1376.
Goetzmann, W.N. (1995), ‘The Informational Efficiency of the Art Market’, *Managerial Finance* **21**, 25-34.
Goetzmann, W.N. (1996), ‘How Costly is the Fall from Fashion? Survivorship Bias in the Painting Market’,‘in: V.A. Ginsburgh and P.M. Menger, eds., *Economics of the Arts: Selected Essays* (Elsevier North-Holland, Amsterdam) 71-84.
Guerzoni, G. (1995), ‘Reflections on Historical Series of Art Prices: Reitlinger’s Data Revisited’, *Journal of Cultural Economics* **19**, 251-260.
Locatelli Biey, M. and Zanola, R. (1999), ‘Investment in Paintings: A Short-Run Price Index, *Journal of Cultural Economics* **23**, 211-222.
Louargand, M.A and McDaniel, J.R. (1991), ‘Price Efficiency in the Art Auction Market’, *Journal of Cultural Economics* **15**, 53-65.
Mei, J. and Moses, M. (2001), ‘Art as an Investment and the Origin of the Masterpiece Effect: Evidence from 1875-2000’, paper presented at the 8th Asia-Pacific Finance Association Annual Conference, Shangri-La Hotel, Bangkok, Thailand, 22-25 July.
Mok, H.M.K., Ko, V.W.K., Woo, S.S.M. and Kwok, K.Y.S. (1993), ‘Modern Chinese Paintings: An Investment Alternative’, *Southern Economic Journal* **59**, 808-816.
Pesando, J.E. (1993), ‘Arts as An Investment: The Market for Modern Prints’, *American Economic Review* **83**, 1075-1089.
Pesando, J.E. and Shum, P.M. (1999), ‘The Returns to Picasso’s Prints and to Traditional Financial Assets, 1977 to 1996’, *Journal of Cultural Economics* **23**, 183-192.
Renneboog, L. and Van Houtte, T. (2002), ‘The Monetary Appreciation of Paintings: from Realism to Magritte’, *Cambridge Journal of Economics* **26**, 331-357.
White, H. (1980), ‘A Heteroscedastistic Consistent Covariance Matrix Estimator and A Direct Test for Heteroscedasticity, *Econometrica* **50**, 1-25.
Worthington, A.C. and Higgs, H. (2003), ‘Art as an Investment: Short and Long-Term Comovements in Major Painting Markets’, *Empirical Economics* **28**, 649-668.
Worthington, A.C. and Higgs, H. (2004), ‘Art as an Investment: Risk, Return and Portfolio Diversification in Major Painting Markets’, *Accounting and Finance* **44**, 257-272.

TABLE 1

Selected Descriptive Statistics of Prices, Medium and Auction House by Artist

Artist	Central tendency, dispersion and distribution of work prices and total works sold							Distribution of works sold by medium											Distribution of works sold by auction house			
Name	Mean	Standard deviation	Skewness	Kurtosis	Jarque-Bera statistic	Jarque-Bera p-value	Number of works sold	Acrylics	Charcoal	Crayon	Etchings	Gouche	Mixed	Oil	Pastels	Pencil	Watercolor	Other mediums	Christies	Deutscher-Menzies	Sotheby's	Other houses
Ashton, John	$2,649	$3,782	3.64	22.13	1.69E+04	0.00	970	0	0	0	43	1	0	818	1	58	45	4	88	8	102	772
Blackman, Charles	$8,006	$20,495	7.64	92.22	8.06E+05	0.00	2361	40	181	16	287	24	67	727	46	38	109	826	385	169	463	1344
Boyd, Arthur	$20,426	$57,305	9.37	121.65	1.08E+06	0.00	1797	3	2	1	274	1	7	934	32	12	28	503	292	135	348	1022
Boyd, David	$2,693	$2,772	8.44	162.12	1.75E+06	0.00	1645	1	3	1	35	3	26	152	2	3	8	43	135	25	107	1378
Boyd, Jamie	$796	$872	1.83	6.18	1.74E+02	0.00	178	0	0	0	2	2	4	132	6	0	7	25	9	3	0	166
Brack, Cecil John	$35,010	$76,521	3.41	16.15	2.68E+03	0.00	293	0	4	3	17	3	3	70	7	21	29	136	63	52	53	125
Bunny, Rupert	$23,837	$75,640	9.83	139.47	4.17E+05	0.00	527	0	0	0	0	0	0	457	0	20	7	43	128	22	156	221
Coburn, John	$3,497	$6,386	3.58	18.01	7.51E+03	0.00	651	58	1	3	1	57	8	198	8	1	28	288	120	58	82	391
Crooke, Ray	$4,000	$6,472	4.45	29.24	6.46E+04	0.00	2020	29	19	16	27	41	34	167	14	9	52	105	246	77	15	1682
Dargie, William	$1,931	$4,317	7.06	63.28	2.81E+04	0.00	176	0	0	3	0	0	1	151	4	6	7	4	32	1	9	134
Dickerson, Robert	$4,326	$8,121	4.86	34.27	7.27E+04	0.00	1628	5	526	11	53	0	8	255	639	1	2	128	215	78	136	1199
Drysdale, George Russell	$32,940	$115,731	6.24	48.36	5.64E+04	0.00	612	0	12	3	13	6	5	126	3	34	44	366	194	41	155	222
Fairweather, Ian	$19,699	$29,316	3.54	21.11	2.68E+03	0.00	170	36	0	0	0	63	16	36	0	3	8	8	59	4	50	57
Fizelle, Reginald Cecil	$1,564	$4,762	7.68	66.14	2.39E+04	0.00	136	0	0	1	0	0	0	12	0	8	110	5	19	1	11	105
Fox, Ethel	$10,172	$20,197	5.67	54.47	3.87E+04	0.00	334	0	0	0	0	20	0	304	0	0	2	8	62	9	61	200
Friend, Donald	$4,272	$8,501	8.75	133.24	1.19E+06	0.00	1647	3	3	11	95	91	19	162	6	18	21	85	28	51	36	944
Fullbrook, Samuel	$8,042	$10,575	2.56	10.78	6.84E+02	0.00	189	0	0	7	1	0	0	150	16	8	3	4	35	13	60	81
Gleeson, James Timothy	$3,310	$7,225	5.5	39.09	3.49E+04	0.00	587	7	15	1	0	1	9	461	7	7	14	65	94	24	10	366
Glover, John	$10,572	$48,580	11.00	141.55	2.57E+05	0.00	314	0	0	0	1	0	0	70	0	10	201	32	66	4	29	215
Gruner, Elioth	$11,195	$14,824	2.68	12.91	2.04E+03	0.00	386	0	5	0	38	0	0	301	1	4	13	24	104	10	67	205
Hart, Kevin Charles (Pro)	$1,442	$2,674	18.23	517.25	2.13E+07	0.00	1922	91	3	2	36	0	0	169	4	4	28	64	54	39	18	1811
Hodgkinson, Frank	$1,526	$2,509	3.80	22.50	3.25E+03	0.00	178	7	3	1	12	30	10	57	1	3	18	36	25	7	8	138
Heysen, Hans	$8,571	$16,653	8.30	101.33	4.97E+05	0.00	1200	0	100	6	19	2	4	167	20	180	670	32	199	20	156	825
Heysen, Nora	$3,158	$5,383	2.49	8.67	2.35E+02	0.00	99	0	1	4	0	0	0	68	1	13	3	9	11	2	11	75
Jackson, James Ranalph	$5,894	$9,662	7.82	92.68	2.39E+05	0.00	693	0	0	0	0	0	0	686	0	0	7	0	84	9	83	517
Lindsay, Norman	$5,822	$13,657	8.16	109.35	1.51E+06	0.00	3132	0	14	0	111	3	1	387	0	484	588	541	324	68	276	2464
Long, Sydney	$4,073	$8,702	9.33	146.12	7.58E+05	0.00	873	0	0	0	298	3	1	245	0	7	258	61	90	12	89	682
McCubbin, Frederick	$55,245	$171,014	7.77	82.03	7.27E+04	0.00	269	0	0	0	0	0	0	256	2	0	11	0	4	3	5	257
Namatjira, Albert	$7,339	$6,132	1.25	5.05	2.57E+02	0.00	593	0	0	0	0	0	0	6	0	1	584	2	98	4	131	360
Nolan, Sidney	$11,182	$42,852	15.23	335.45	1.12E+07	0.00	2405	103	7	78	31	6	179	788	24	6	17	116	461	133	460	1351

Artist	Central tendency, dispersion and distribution of work prices and total works sold							Distribution of works sold by medium											Distribution of works sold by auction house			
Name	Mean	Standard deviation	Skewness	Kurtosis	Jarque-Bera statistic	Jarque-Bera p-value	Number of works sold	Acrylics	Charcoal	Crayon	Etchings	Gouche	Mixed	Oil	Pastels	Pencil	Watercolor	Other mediums	Christies	Deutscher-Menzies	Sotheby's	Other houses
Olley, Margaret	$12,529	$15,930	1.76	5.82	2.36E+02	0.00	278	0	0	1	0	1	4	216	1	0	28	27	74	14	62	128
Olsen, John	$9,118	$24,821	10.35	155.72	1.13E+06	0.00	1145	5	8	27	155	53	129	136	51	16	267	298	232	135	200	578
Perceval, John	$14,133	$38,256	8.17	91.01	2.27E+05	0.00	679	2	3	6	10	1	13	338	6	139	4	157	151	63	153	312
Preston, Margaret	$12,470	$26,244	6.59	69.81	7.34E+04	0.00	380	0	1	1	0	13	4	106	1	1	9	244	81	14	85	200
Proctor, Althea	$1,867	$3,072	4.10	28.21	9.96E+03	0.00	340	0	6	21	2	0	0	0	7	74	96	134	62	4	37	237
Rees, Lloyd	$9,617	$20,669	4.25	25.15	2.34E+04	0.00	997	0	13	1	153	1	21	220	10	113	51	414	132	47	217	601
Roberts, Thomas William	$24,168	$48,848	4.37	25.52	6.15E+03	0.00	253	0	4	2	9	2	0	193	14	9	9	11	67	4	57	125
Russell, John Peter	$45,167	$100,079	3.86	20.57	1.93E+03	0.00	126	0	2	1	0	2	0	49	4	5	62	1	47	4	42	33
Smart, Frank Jeffrey	$36,544	$51,774	2.29	8.75	6.64E+02	0.00	295	14	0	1	9	11	3	211	2	1	14	29	70	25	110	90
Smith, Grace Cossington	$17,204	$30,323	5.06	37.46	1.38E+04	0.00	257	0	0	3	0	1	1	232	1	14	4	1	76	9	69	103
Streeton, Arthur	$31,800	$61,587	6.13	59.44	1.10E+05	0.00	790	0	0	0	0	0	1	510	1	50	208	20	159	25	184	422
Tucker, Albert	$14,764	$38,791	11.68	170.20	3.68E+05	0.00	310	27	1	2	0	6	24	218	2	0	14	16	76	12	78	144
Whiteley, Brett	$23,927	$82,465	12.22	228.22	2.14E+06	0.00	1000	2	32	5	175	8	45	166	2	24	17	524	244	89	216	451
Williams, Frederick	$21,305	$49,779	5.34	41.10	3.93E+04	0.00	602	4	11	5	120	156	6	115	2	4	28	151	146	54	174	228
Withers, Walter	$12,097	$30,502	6.96	68.10	6.80E+04	0.00	368	0	0	1	0	0	0	208	5	16	138	0	62	9	61	236

TABLE 2

Estimated Coefficients, Standard Errors and Percentage Changes in Price for the Hedonic Pricing Equations

		ACR	CHA	CRA	ETC	GOU	MIX	OIL	PAS	PEN	WCO	ARE	ASQ	CHR	DEU	SOT	Adj R^2
ASH	Coefficient	–	–	–	-0.391	0.759	–	1.643	1.673	0.085	0.860	5.226	-2.523	0.455	0.266	0.366	0.745
	Standard error	–	–	–	0.285	0.341	–	0.281	0.285	0.301	0.289	0.363	0.306	0.081	0.255	0.074	
	p-value	–	–	–	0.171	0.026	–	0.000	0.000	0.779	0.003	0.000	0.000	0.000	0.296	0.000	
	Percentage change	–	–	–	0.677	2.137	–	5.172	5.327	1.088	2.363	0.812	-0.224	1.576	1.305	1.442	
BLC	Coefficient	1.521	0.942	0.565	-0.352	1.064	1.344	1.926	1.185	0.756	1.125	1.060	-0.137	1.026	1.011	0.842	0.742
	Standard error	0.135	0.074	0.185	0.047	0.153	0.116	0.059	0.108	0.149	0.078	0.088	0.026	0.062	0.091	0.062	
	p-value	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
	Percentage change	4.575	2.566	1.760	0.703	2.898	3.834	6.860	3.271	2.130	3.081	0.567	-0.219	2.791	2.750	2.321	
BYA	Coefficient	1.513	1.136	1.279	-0.384	1.180	1.170	2.332	1.827	-0.002	0.800	1.123	-0.100	0.773	0.490	0.882	0.796
	Standard error	0.160	0.147	0.186	0.066	0.258	0.188	0.073	0.135	0.203	0.145	0.068	0.013	0.070	0.077	0.070	
	p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.991	0.000	0.000	0.000	0.000	0.000	0.000	
	Percentage change	4.540	3.115	3.592	0.681	3.255	3.222	10.298	6.213	0.998	2.226	0.641	-0.180	2.166	1.633	2.415	
BYD	Coefficient	1.191	0.049	0.495	-0.125	0.723	0.905	1.318	1.017	0.274	0.360	1.907	-0.328	0.138	0.300	0.118	0.623
	Standard error	0.166	0.372	0.158	0.174	0.244	0.195	0.157	0.192	0.373	0.262	0.094	0.033	0.050	0.057	0.051	
	p-value	0.000	0.895	0.002	0.473	0.003	0.000	0.000	0.000	0.462	0.169	0.000	0.000	0.006	0.000	0.021	
	Percentage change	3.290	1.050	1.641	0.882	2.060	2.472	3.737	2.764	1.315	1.434	0.564	-0.116	1.148	1.350	1.125	
BYJ	Coefficient	–	–	–	0.159	1.868	1.747	1.427	1.461	–	0.062	1.239	-0.145	0.839	1.006	–	0.641
	Standard error	–	–	–	0.523	0.213	0.279	0.149	0.294	–	0.357	0.198	0.026	0.274	0.268	–	
	p-value	–	–	–	0.761	0.000	0.000	0.000	0.000	–	0.863	0.000	0.000	0.003	0.000	–	
	Percentage change	–	–	–	1.173	6.477	5.736	4.166	4.310	–	1.064	0.611	-0.320	2.314	2.734	–	
BRA	Coefficient	–	1.658	2.682	0.186	2.833	1.945	3.077	2.427	1.600	2.134	0.740	-0.016	0.402	0.460	0.467	0.848
	Standard error	–	0.161	0.316	0.219	0.378	1.220	0.290	0.145	0.223	0.197	0.430	0.121	0.194	0.170	0.152	
	p-value	–	0.000	0.000	0.398	0.000	0.112	0.000	0.000	0.000	0.000	0.086	0.897	0.039	0.007	0.002	
	Percentage change	–	5.251	14.612	1.204	16.993	6.991	21.700	11.326	4.955	8.449	0.329	-0.014	1.495	1.585	1.596	
BUN	Coefficient	–	–	–	–	–	–	0.456	–	-1.137	-0.102	4.085	-0.634	0.405	0.088	0.299	0.682
	Standard error	–	–	–	–	–	–	0.174	–	0.224	0.227	0.411	0.101	0.123	0.251	0.128	
	p-value	–	–	–	–	–	–	0.009	–	0.000	0.654	0.000	0.000	0.001	0.727	0.019	
	Percentage change	–	–	–	–	–	–	1.577	–	0.321	0.903	1.016	-0.237	1.500	1.092	1.349	
COB	Coefficient	1.090	0.189	1.453	0.488	1.107	0.952	1.372	0.460	0.777	0.985	0.940	-0.072	0.371	0.126	0.302	0.815
	Standard error	0.094	0.116	0.503	0.233	0.086	0.264	0.069	0.211	0.066	0.108	0.127	0.031	0.071	0.086	0.084	
	p-value	0.000	0.105	0.004	0.037	0.000	0.000	0.000	0.030	0.000	0.000	0.000	0.021	0.000	0.143	0.000	
	Percentage change	2.975	1.208	4.275	1.628	3.024	2.590	3.942	1.585	2.176	2.678	0.644	-0.184	1.448	1.135	1.353	
CRO	Coefficient	1.338	0.316	0.496	0.086	0.954	1.273	1.779	1.182	0.139	0.794	2.674	-0.662	0.314	0.161	0.224	0.762
	Standard error	0.132	0.145	0.155	0.094	0.111	0.120	0.072	0.131	0.166	0.112	0.135	0.097	0.047	0.079	0.047	
	p-value	0.000	0.029	0.001	0.364	0.000	0.000	0.000	0.000	0.402	0.000	0.000	0.000	0.000	0.042	0.000	
	Percentage change	3.813	1.371	1.642	1.089	2.597	3.570	5.925	3.260	1.149	2.213	0.869	-0.283	1.369	1.175	1.251	
DAR	Coefficient	–	–	1.073	–	–	1.996	1.480	2.177	1.031	0.180	1.575	-0.092	0.852	1.727	0.008	0.650
	Standard error	–	–	0.548	–	–	0.416	0.334	0.430	0.388	0.491	0.760	0.390	0.165	0.346	0.345	
	p-value	–	–	0.052	–	–	0.000	0.000	0.000	0.009	0.715	0.040	0.814	0.000	0.000	0.981	
	Percentage change	–	–	2.925	–	–	7.361	4.392	8.821	2.804	1.197	0.296	-0.016	2.345	5.623	1.008	

		ACR	CHA	CRA	ETC	GOU	MIX	OIL	PAS	PEN	WCO	ARE	ASQ	CHR	DEU	SOT	Adj R^2
DIC	Coefficient	1.870	0.941	1.313	-0.513	–	1.065	1.768	1.370	0.902	0.967	1.583	-0.152	0.332	0.131	0.186	0.839
	Standard error	0.287	0.090	0.117	0.107	–	0.215	0.103	0.090	0.160	0.101	0.078	0.015	0.045	0.069	0.059	
	p-value	0.000	0.000	0.000	0.000	–	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.057	0.002	
	Percentage change	6.488	2.564	3.717	0.599	–	2.902	5.859	3.935	2.464	2.631	0.579	-0.100	1.393	1.140	1.205	
DRY	Coefficient	–	0.049	0.572	-1.592	1.544	1.322	2.985	0.734	0.107	0.647	0.274	0.924	0.609	0.528	0.614	0.781
	Standard error	–	0.263	0.346	0.225	0.403	0.476	0.144	0.329	0.146	0.117	0.502	0.421	0.101	0.193	0.118	
	p-value	–	0.852	0.099	0.000	0.000	0.006	0.000	0.026	0.464	0.000	0.106	0.490	0.000	0.006	0.000	
	Percentage change	–	1.050	1.772	0.204	4.685	3.751	19.792	2.083	1.113	1.910	0.048	0.153	1.839	1.695	1.848	
FAI	Coefficient	1.213	–	–	–	1.291	0.933	1.272	–	0.183	0.193	2.342	-0.792	0.573	1.055	0.470	0.842
	Standard error	0.307	–	–	–	0.272	0.333	0.281	–	0.466	0.325	0.355	0.166	0.158	0.276	0.158	
	p-value	0.000	–	–	–	0.000	0.006	0.000	–	0.696	0.554	0.000	0.000	0.000	0.000	0.004	
	Percentage change	3.362	–	–	–	3.638	2.542	3.567	–	1.200	1.212	0.906	-0.420	1.773	2.871	1.600	
FIZ	Coefficient	–	–	-1.864	–	–	–	0.172	–	-0.029	0.422	5.451	1.873	0.422	0.383	0.909	0.547
	Standard error	–	–	0.553	–	–	–	0.414	–	0.366	0.230	2.976	5.932	0.229	0.419	0.296	
	p-value	–	–	0.001	–	–	–	0.679	–	0.938	0.069	0.070	0.753	0.069	0.364	0.003	
	Percentage change	–	–	0.155	–	–	–	1.188	–	0.972	1.526	0.803	0.109	1.525	1.466	2.481	
FOX	Coefficient	–	–	–	–	1.130	–	1.524	–	–	1.071	4.781	-3.190	0.866	0.883	0.958	0.582
	Standard error	–	–	–	–	0.391	–	0.355	–	–	0.508	1.151	1.685	0.182	0.329	0.189	
	p-value	–	–	–	–	0.004	–	0.000	–	–	0.036	0.000	0.059	0.000	0.008	0.000	
	Percentage change	–	–	–	–	3.095	–	4.590	–	–	2.917	0.679	-0.240	2.376	2.418	2.607	
FRI	Coefficient	1.780	-0.552	0.469	-0.746	0.819	0.870	1.599	0.910	0.183	0.771	2.834	-1.024	1.278	1.264	1.273	0.633
	Standard error	0.618	0.167	0.143	0.087	0.081	0.072	0.078	0.280	0.167	0.062	0.267	0.259	0.061	0.137	0.062	
	p-value	0.004	0.001	0.001	0.000	0.000	0.000	0.000	0.001	0.273	0.000	0.000	0.000	0.000	0.000	0.000	
	Percentage change	5.932	0.576	1.598	0.474	2.268	2.388	4.950	2.485	1.201	2.162	0.620	-0.183	3.589	3.540	3.571	
FUL	Coefficient	–	–	0.578	1.457	–	–	2.083	0.753	0.137	0.578	3.255	-1.210	0.507	0.350	0.257	0.803
	Standard error	–	–	0.510	0.509	–	–	0.499	0.502	0.527	0.700	0.597	0.419	0.173	0.259	0.164	
	p-value	–	–	0.259	0.005	–	–	0.000	0.136	0.796	0.410	0.000	0.005	0.004	0.179	0.118	
	Percentage change	–	–	1.783	4.293	–	–	8.027	2.123	1.146	1.783	0.748	-0.251	1.660	1.419	1.294	
GLE	Coefficient	0.698	-0.163	1.006		0.399	0.408	1.019	0.339	0.066	-0.145	1.525	-0.219	0.567	0.098	0.495	0.779
	Standard error	0.191	0.199	0.128		0.131	0.248	0.121	0.276	0.129	0.218	0.192	0.046	0.091	0.182	0.074	
	p-value	0.000	0.413	0.000		0.002	0.100	0.000	0.219	0.610	0.508	0.000	0.000	0.000	0.592	0.000	
	Percentage change	2.009	0.850	2.734	1.000	1.491	1.503	2.770	1.404	1.068	0.865	0.252	-0.148	1.764	1.103	1.641	
GLO	Coefficient	–	–	–	0.573	–	–	1.754	–	0.581	0.875	4.375	-2.241	0.825	0.988	0.918	0.690
	Standard error	–	–	–	0.393	–	–	0.263	–	0.449	0.189	0.688	0.698	0.177	0.320	0.232	
	p-value	–	–	–	0.146	–	–	0.000	–	0.197	0.000	0.000	0.002	0.000	0.002	0.000	
	Percentage change	–	–	–	1.774	–	–	5.778	–	1.787	2.399	1.206	-0.736	2.283	2.687	2.505	
GRU	Coefficient	–	1.710	–	0.063	–	–	2.913	1.748	1.024	1.263	2.677	-0.935	0.206	0.910	0.450	0.793
	Standard error	–	0.340	–	0.170	–	–	0.168	0.242	0.474	0.220	0.857	0.922	0.104	0.198	0.122	
	p-value	–	0.000	–	0.711	–	–	0.000	0.000	0.031	0.000	0.002	0.311	0.049	0.000	0.000	
	Percentage change	–	5.529	–	1.065	–	–	18.413	5.743	2.784	3.538	0.288	-0.052	1.229	2.485	1.569	

		ACR	CHA	CRA	ETC	GOU	MIX	OIL	PAS	PEN	WCO	ARE	ASQ	CHR	DEU	SOT	Adj R^2
HRT	Coefficient	1.788	0.988	0.976	0.451	–	–	1.744	0.222	0.155	1.172	2.291	-0.396	0.174	0.366	0.210	0.629
	Standard error	0.138	0.164	0.146	0.139	–	–	0.123	0.213	0.204	0.150	0.106	0.058	0.102	0.105	0.193	
	p-value	0.000	0.000	0.000	0.001	–	–	0.000	0.297	0.447	0.000	0.000	0.000	0.087	0.001	0.277	
	Percentage change	5.978	2.685	2.654	1.570	–	–	5.721	1.249	1.168	3.228	0.521	-0.114	1.191	1.442	1.233	
HOD	Coefficient	1.210	0.687	0.435	0.273	1.282	1.422	1.768	-0.837	1.180	1.298	1.027	-0.134	0.526	0.977	0.866	0.802
	Standard error	0.220	0.202	0.217	0.189	0.193	0.219	0.179	0.280	0.552	0.233	0.237	0.055	0.173	0.286	0.263	
	p-value	0.000	0.001	0.047	0.151	0.000	0.000	0.000	0.003	0.035	0.000	0.000	0.016	0.003	0.001	0.001	
	Percentage change	3.355	1.987	1.545	1.313	3.604	4.143	5.857	0.433	3.254	3.660	0.598	-0.209	1.693	2.656	2.377	
HYH	Coefficient	–	0.068	-0.203	-0.354	0.386	0.779	0.854	0.844	-0.035	1.264	9.998	-6.408	0.180	0.241	0.195	0.776
	Standard error	–	0.115	0.140	0.126	0.272	0.383	0.125	0.252	0.106	0.104	0.483	0.588	0.060	0.164	0.052	
	p-value	–	0.554	0.147	0.005	0.156	0.042	0.000	0.001	0.745	0.000	0.000	0.000	0.003	0.143	0.000	
	Percentage change	–	1.071	0.816	0.702	1.471	2.179	2.348	2.327	0.966	3.538	1.228	-0.363	1.198	1.272	1.215	
HYN	Coefficient	–	0.712	-0.358	–	–	–	2.353	1.571	1.356	2.268	2.338	-4.881	0.300	0.219	0.224	0.725
	Standard error	–	0.326	0.657	–	–	–	0.401	0.632	0.510	0.440	2.483	2.753	0.384	0.709	0.278	
	p-value	–	0.033	0.588	–	–	–	0.000	0.016	0.010	0.000	0.350	0.081	0.438	0.758	0.425	
	Percentage change	–	2.038	0.699	–	–	–	10.521	4.812	3.880	9.663	0.439	-0.496	1.349	1.245	1.251	
JAC	Coefficient	–	–	–	–	–	–	1.753	–	–	–	5.735	-2.692	0.512	0.916	0.581	0.649
	Standard error	–	–	–	–	–	–	0.299	–	–	–	0.570	0.840	0.082	0.241	0.083	
	p-value	–	–	–	–	–	–	0.000	–	–	–	0.000	0.001	0.000	0.000	0.000	
	Percentage change	–	–	–	–	–	–	5.774	–	–	–	0.166	-0.324	1.668	2.500	1.788	
LIN	Coefficient	–	-0.155	–	0.624	1.113	-0.232	1.761	–	0.063	1.633	5.630	-2.217	0.267	0.378	0.400	0.705
	Standard error	–	0.166	–	0.037	0.375	0.086	0.058	–	0.046	0.051	0.255	0.264	0.044	0.086	0.046	
	p-value	–	0.349	–	0.000	0.003	0.007	0.000	–	0.173	0.000	0.000	0.000	0.000	0.000	0.000	
	Percentage change	–	0.856	–	1.867	3.044	0.793	5.819	–	1.065	5.119	0.612	-0.117	1.306	1.459	1.492	
LON	Coefficient	–	–	–	-0.393	0.968	0.199	1.463	–	-0.363	1.310	5.555	-2.993	0.234	0.636	0.375	0.764
	Standard error	–	–	–	0.107	0.453	0.142	0.130	–	0.424	0.119	0.790	1.187	0.100	0.304	0.094	
	p-value	–	–	–	0.000	0.033	0.161	0.000	–	0.392	0.000	0.000	0.012	0.020	0.037	0.000	
	Percentage change	–	–	–	0.675	2.632	1.220	4.319	–	0.695	3.706	0.665	-0.153	1.263	1.888	1.455	
MCC	Coefficient	–	–	–	–	–	–	0.954	0.447	–	–	4.452	-0.945	-0.327	-0.252	0.016	0.733
	Standard error	–	–	–	–	–	–	0.148	0.192	–	–	0.297	0.075	0.321	0.306	0.280	
	p-value	–	–	–	–	–	–	0.000	0.021	–	–	0.000	0.000	0.309	0.411	0.955	
	Percentage change	–	–	–	–	–	–	2.595	1.564	–	–	0.856	-0.315	0.721	0.777	1.016	
NAM	Coefficient	–	–	–	–	–	–	1.551	–	2.308	2.627	14.519	-33.002	0.292	0.910	0.405	0.609
	Standard error	–	–	–	–	–	–	0.358	–	0.252	0.176	2.959	9.873	0.078	0.176	0.081	
	p-value	–	–	–	–	–	–	0.000	–	0.000	0.000	0.000	0.001	0.000	0.000	0.000	
	Percentage change	–	–	–	–	–	–	4.716	–	10.054	13.839	1.480	-0.799	1.340	2.483	1.500	
NOL	Coefficient	0.942	0.165	-0.213	-0.489	0.496	0.621	1.119	-0.119	0.059	0.462	1.278	-0.087	1.164	0.616	1.268	0.595
	Standard error	0.104	0.283	0.088	0.129	0.254	0.077	0.053	0.161	0.172	0.168	0.060	0.005	0.059	0.116	0.069	
	p-value	0.000	0.559	0.016	0.000	0.051	0.000	0.000	0.461	0.734	0.006	0.000	0.000	0.000	0.000	0.000	
	Percentage change	2.564	1.180	0.808	0.613	1.642	1.861	3.061	0.888	1.060	1.588	0.619	-0.124	3.202	1.851	3.552	

		ACR	CHA	CRA	ETC	GOU	MIX	OIL	PAS	PEN	WCO	ARE	ASQ	CHR	DEU	SOT	Adj R^2
OLL	Coefficient	–	–	0.189	–	-0.380	-0.433	0.960	0.780	–	0.179	5.296	-3.165	0.286	-0.031	0.247	0.889
	Standard error	–	–	0.184	–	0.336	0.272	0.148	0.204	–	0.191	0.523	0.387	0.130	0.153	0.099	
	p-value	–	–	0.306	–	0.259	0.112	0.000	0.000	–	0.351	0.000	0.000	0.029	0.840	0.014	
	Percentage change	–	–	1.208	–	0.684	0.648	2.612	2.181	–	1.196	2.504	-1.980	1.331	0.969	1.280	
OLS	Coefficient	1.654	0.564	1.315	-0.234	1.229	1.321	1.700	1.050	0.548	1.519	0.965	-0.053	0.556	0.468	0.478	0.797
	Standard error	0.332	0.322	0.117	0.074	0.116	0.086	0.100	0.110	0.160	0.063	0.054	0.005	0.065	0.074	0.066	
	p-value	0.000	0.080	0.000	0.002	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	
	Percentage change	5.228	1.758	3.723	0.792	3.418	3.746	5.474	2.859	1.730	4.566	0.602	-0.147	1.743	1.597	1.613	
PER	Coefficient	0.301	-0.539	-0.461	-1.030	0.399	-0.589	0.969	0.451	-0.221	0.107	2.404	-0.433	0.588	0.455	0.739	0.632
	Standard error	0.189	0.208	0.300	0.182	0.214	0.222	0.135	0.250	0.116	0.496	0.403	0.275	0.111	0.166	0.101	
	p-value	0.112	0.010	0.125	0.000	0.062	0.008	0.000	0.072	0.058	0.830	0.000	0.116	0.000	0.006	0.000	
	Percentage change	1.351	0.583	0.631	0.357	1.491	0.555	2.636	1.570	0.802	1.112	0.836	-0.187	1.801	1.576	2.094	
PRE	Coefficient	–	-1.231	0.317	–	0.831	0.223	0.777	1.187	0.374	-0.010	6.364	-3.131	0.321	0.802	0.611	0.772
	Standard error	–	0.160	0.197	–	0.193	0.383	0.154	0.199	0.210	0.285	1.108	0.795	0.135	0.225	0.129	
	p-value	–	0.000	0.109	–	0.000	0.561	0.000	0.000	0.076	0.972	0.000	0.000	0.018	0.000	0.000	
	Percentage change	–	0.292	1.374	–	2.295	1.250	2.176	3.277	1.454	0.990	0.793	-0.235	1.379	2.230	1.842	
PRO	Coefficient	–	-0.392	-0.595	0.563	–	–	–	0.200	-0.414	1.104	-3.312	9.119	0.438	0.650	0.841	0.578
	Standard error	–	0.338	0.151	0.285	–	–	–	0.414	0.125	0.140	1.766	2.843	0.150	0.182	0.161	
	p-value	–	0.248	0.000	0.049	–	–	–	0.629	0.001	0.000	0.062	0.002	0.004	0.000	0.000	
	Percentage change	–	0.676	0.551	1.756	–	–	–	1.222	0.661	3.017	-0.298	0.201	1.549	1.916	2.319	
REE	Coefficient	–	1.252	2.520	-0.162	1.563	1.136	2.387	1.143	1.090	1.384	1.114	0.042	0.892	0.468	0.583	0.747
	Standard error	–	0.160	0.117	0.087	0.347	0.193	0.083	0.154	0.103	0.093	0.317	0.274	0.084	0.144	0.078	
	p-value	–	0.000	0.000	0.064	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.879	0.000	0.001	0.000	
	Percentage change	–	3.497	12.423	0.850	4.772	3.113	10.880	3.135	2.976	3.989	0.224	0.007	2.439	1.596	1.792	
RBT	Coefficient	–	-0.026	0.863	-0.079	3.253	–	1.802	1.472	-1.091	0.934	2.082	-0.319	0.244	0.637	0.560	0.602
	Standard error	–	0.421	0.818	0.420	0.337	–	0.314	0.412	0.502	0.443	0.694	0.396	0.168	0.383	0.191	
	p-value	–	0.951	0.293	0.851	0.000	–	0.000	0.000	0.031	0.036	0.003	0.422	0.147	0.098	0.004	
	Percentage change	–	0.975	2.369	0.924	25.868	–	6.064	4.359	0.336	2.544	0.319	-0.041	1.277	1.890	1.750	
RUS	Coefficient	–	-0.560	0.128	–	1.613	–	1.461	0.255	0.562	0.765	12.741	-11.289	0.875	1.248	0.699	0.751
	Standard error	–	0.604	0.057	–	0.511	–	0.385	0.623	0.441	0.321	2.398	3.594	0.383	0.694	0.375	
	p-value	–	0.356	0.028	–	0.002	–	0.000	0.683	0.206	0.020	0.000	0.002	0.025	0.076	0.066	
	Percentage change	–	0.571	1.137	–	5.018	–	4.310	1.291	1.754	2.149	2.207	-1.142	2.398	3.483	2.011	
SMA	Coefficient	2.058	–	0.551	-0.053	1.614	1.577	1.989	-0.076	0.642	0.643	3.182	-1.142	0.427	0.287	0.468	0.878
	Standard error	0.217	–	0.204	0.206	0.212	0.199	0.175	0.558	0.461	0.264	0.406	0.340	0.124	0.157	0.118	
	p-value	0.000	–	0.007	0.798	0.000	0.000	0.000	0.892	0.164	0.016	0.000	0.001	0.001	0.069	0.000	
	Percentage change	7.830	–	1.735	0.949	5.022	4.842	7.308	0.927	1.901	1.902	0.994	-0.378	1.533	1.332	1.597	
SMI	Coefficient	–	–	2.384	–	4.223	1.904	3.070	2.495	1.370	2.485	0.428	-0.003	0.478	0.481	0.675	0.735
	Standard error	–	–	0.325	–	0.335	0.321	0.290	0.390	0.340	0.489	0.137	0.021	0.143	0.291	0.166	
	p-value	–	–	0.000	–	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.882	0.001	0.100	0.000	
	Percentage change	–	–	10.851	–	68.217	6.710	21.551	12.116	3.934	11.996	0.626	-0.020	1.613	1.618	1.964	

		ACR	CHA	CRA	ETC	GOU	MIX	OIL	PAS	PEN	WCO	ARE	ASQ	CHR	DEU	SOT	Adj R^2
STR	Coefficient	–	–	–	–	–	1.277	2.555	1.743	-0.114	0.979	1.624	-0.370	0.419	0.468	0.504	0.723
	Standard error	–	–	–	–	–	0.230	0.216	0.280	0.230	0.211	0.280	0.115	0.089	0.240	0.097	
	p-value	–	–	–	–	–	0.000	0.000	0.000	0.620	0.000	0.000	0.001	0.000	0.052	0.000	
	Percentage change	–	–	–	–	–	3.587	12.865	5.716	0.892	2.661	0.371	-0.099	1.521	1.597	1.656	
TUC	Coefficient	2.053	-0.164	1.415	–	1.684	1.951	2.121	2.457	–	1.801	2.591	-0.820	0.267	0.290	0.701	0.779
	Standard error	0.316	0.438	0.594	–	0.373	0.305	0.265	0.520	–	0.294	0.429	0.346	0.119	0.240	0.114	
	p-value	0.000	0.708	0.018	–	0.000	0.000	0.000	0.000	–	0.000	0.000	0.019	0.026	0.229	0.000	
	Percentage change	7.793	0.849	4.116	–	5.385	7.033	8.336	11.673	–	6.057	0.878	-0.353	1.306	1.336	2.017	
WHI	Coefficient	1.682	0.626	0.974	-0.198	1.091	1.475	1.851	-0.012	0.705	1.030	1.016	-0.082	0.496	0.339	0.552	0.769
	Standard error	0.657	0.164	0.359	0.064	0.158	0.131	0.089	0.386	0.124	0.278	0.086	0.015	0.075	0.120	0.073	
	p-value	0.011	0.000	0.007	0.002	0.000	0.000	0.000	0.975	0.000	0.000	0.000	0.000	0.000	0.005	0.000	
	Percentage change	5.379	1.870	2.648	0.821	2.976	4.373	6.368	0.988	2.024	2.801	0.593	-0.168	1.643	1.404	1.737	
WIL	Coefficient	2.324	0.809	1.507	0.434	2.280	1.726	2.471	1.054	-0.140	1.544	2.471	-0.416	0.292	0.193	0.282	0.877
	Standard error	0.146	0.187	0.189	0.086	0.107	0.349	0.172	0.628	0.196	0.184	0.220	0.046	0.086	0.101	0.083	
	p-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.094	0.474	0.000	0.000	0.000	0.001	0.056	0.001	
	Percentage change	10.220	2.246	4.514	1.543	9.780	5.621	11.838	2.870	0.869	4.682	0.078	-0.301	1.339	1.213	1.326	
WTH	Coefficient	–	–	-0.456	–	–	–	1.202	-0.037	-1.570	–	9.151	-6.276	-0.021	0.475	0.321	0.759
	Standard error	–	–	0.265	–	–	–	0.084	0.276	0.230	–	0.911	0.827	0.124	0.284	0.114	
	p-value	–	–	0.086	–	–	–	0.000	0.893	0.000	–	0.000	0.000	0.868	0.096	0.005	
	Percentage change	–	–	0.634	–	–	–	3.328	0.963	0.208	–	1.019	-0.324	0.980	1.608	1.378	

Notes: Ashton, John – ASH, Blackman, Charles – BLA, Boyd, Arthur – BYA, Boyd, David – BYD, Boyd, Jamie – BYJ, Brack, Cecil John – BRA, Bunny, Rupert – BUN, Coburn, John – COB, Crooke, Ray – CRO, Dargie, William – DAR, Dickerson, Robert – DIC, Drysdale, George Russell – DRY, Fairweather, Ian – FAI, Fizelle, Reginald Cecil – FIZ, Fox, Ethel – FOX, Friend, Donald – FRI, Fullbrook, Samuel – FUL, Gleeson, James – GLE, Glover, John – GLO, Gruner, Elioth – GRU, Hart, Kevin Charles Pro – HAR, Hodgkinson, Frank – HOD, Heysen, Hans – HYH, Heysen, Nora - HYN, Jackson, James Ranalph – JAC, Lindsay, Norman – LIN, Long, Sydney – LON, McCubbin, Frederick – MCC, Namatjira, Albert – NAM, Nolan, Sidney – NOL, Olley, Margaret – OLL, Olsen, John – OLS, Perceval, John – PER, Preston, Margaret – PRE, Proctor, Althea – PRO, Rees, Lloyd – REE, Roberts, Thomas William – RBT, Russell, John Peter – RUS, Smart, Frank Jeffrey – SMA, Smith, Grace Cossington – SMI, Streeton, Arthur – STR, Tucker, Albert – TUC, Whiteley, Brett – WHI, Williams, Frederick – WIL, Withers, Walter – WTH; Acrylic – ACR, charcoal – CHA, crayon – CRA, etching – ETC, gouache – GOU, mixed media – MIX, oil – OIL, pastel – PAS, pencil – PEN and watercolour – WCO; Area – ARE and area squared – ASQ; Christies - CHR, Deutscher-Menzies – DEU and Sotheby's – SOT.

TABLE 3

Return, risk, performance measures and betas of art investments, 1973-2003

Artist	Mean		Standard deviation		Sharpe ratio		Treynor ratio		Beta	
	Statistic	Rank	Statistic	Rank	Statistic	Rank	Statistic	Rank	Statistic	Rank
ASH	0.062	33	0.264	7	0.045	25	0.044	18	0.271	28
BLA	0.077	23	0.277	10	0.097	22	0.075	10	0.358	23
BYA	0.057	38	0.317	17	0.022	35	0.030	22	0.232	30
BYD	0.063	30	0.211	4	0.062	36	0.035	20	0.373	21
BYJ	0.066	28	0.612	40	0.026	27	0.014	28	1.153	3
BRA	0.138	3	0.566	38	0.155	4	0.273	5	0.322	26
BUN	0.082	21	0.447	32	0.072	20	0.036	19	0.897	7
COB	0.083	19	0.297	15	0.111	18	-0.113	38	-0.291	42
CRO	0.051	41	0.232	5	0.004	44	0.003	33	0.343	24
DAR	0.049	42	0.533	37	-0.002	34	-0.001	34	0.970	6
DIC	0.092	16	0.200	2	0.210	10	0.116	7	0.362	22
DRY	0.059	34	0.401	26	0.022	32	0.022	25	0.418	19
FAI	0.101	14	0.659	41	0.077	16	-0.333	42	-0.153	38
FIZ	0.067	27	0.447	32	0.038	28	0.033	21	0.522	17
FOX	0.074	24	0.484	36	0.050	25	0.024	23	1.017	5
FRI	0.037	45	0.348	19	-0.037	45	-0.023	36	0.563	13
FUL	0.101	14	0.775	42	0.066	17	-0.392	44	-0.130	37
GLE	0.074	24	0.294	14	0.082	24	0.099	8	0.242	29
GLO	0.064	29	0.472	35	0.030	29	-0.326	41	-0.043	36
GRU	0.048	43	0.423	28	-0.005	39	0.007	32	-0.304	43
HAR	0.058	37	0.189	1	0.042	42	0.070	14	0.114	33
HOD	0.107	8	0.600	39	0.095	14	-0.098	37	-0.582	45
HYH	0.059	34	0.235	6	0.038	40	0.014	29	0.662	9
HYN	0.074	24	0.847	43	0.028	26	0.072	12	0.334	25
JAC	0.059	34	0.274	9	0.033	37	0.016	27	0.568	11
LIN	0.057	38	0.201	3	0.035	43	0.012	30	0.606	10
LON	0.092	16	0.301	16	0.140	13	0.328	4	0.128	32
MCC	0.103	10	0.434	30	0.122	11	0.697	2	0.076	34
NAM	0.085	18	0.271	8	0.129	15	0.071	13	0.494	18
NOL	0.054	40	0.330	18	0.012	38	0.007	31	0.562	14
OLL	0.135	4	0.404	27	0.210	3	0.159	6	0.533	15
OLS	0.109	7	0.391	22	0.151	9	-0.383	43	-0.154	39
PER	0.063	30	0.398	24	0.033	31	0.073	11	0.177	31
PRE	0.102	12	0.444	31	0.117	12	0.050	16	1.047	4
PRO	0.112	6	0.361	21	0.172	5	-0.138	39	-0.450	44
REE	0.079	22	0.360	20	0.081	21	0.054	15	0.533	15
RBT	0.083	19	1.933	45	0.017	23	0.080	9	0.412	20
RUS	0.107	8	1.477	44	0.039	19	0.017	26	3.339	1
SMA	0.146	2	0.456	34	0.211	2	-0.593	45	-0.162	40
SMI	0.116	5	0.428	29	0.154	7	0.046	17	1.425	2
STR	0.103	10	0.283	12	0.187	6	2.304	1	0.023	35
TUC	0.063	30	0.398	24	0.033	30	0.023	24	0.566	12
WHI	0.147	1	0.281	11	0.345	1	0.339	3	0.286	27
WIL	0.102	12	0.290	13	0.179	8	-0.243	40	-0.214	41
WTH	0.043	44	0.392	23	-0.018	41	-0.009	35	0.807	8

Notes: Ashton, John – ASH, Blackman, Charles – BLA, Boyd, Arthur – BYA, Boyd, David – BYD, Boyd, Jamie – BYJ, Brack, Cecil John – BRA, Bunny, Rupert – BUN, Coburn, John – COB, Crooke, Ray – CRO, Dargie, William – DAR, Dickerson, Robert – DIC, Drysdale, George Russell – DRY, Fairweather, Ian – FAI, Fizelle, Reginald Cecil – FIZ, Fox, Ethel – FOX, Friend, Donald – FRI, Fullbrook, Samuel – FUL, Gleeson, James – GLE, Glover, John – GLO, Gruner, Elioth – GRU, Hart, Kevin Charles Pro – HAR, Hodgkinson, Frank – HOD, Heysen, Hans – HYH, Heysen, Nora - HYN, Jackson, James Ranalph – JAC, Lindsay, Norman – LIN, Long, Sydney – LON, McCubbin, Frederick – MCC, Namatjira, Albert – NAM, Nolan, Sidney – NOL, Olley, Margaret – OLL, Olsen, John – OLS, Perceval, John – PER, Preston, Margaret – PRE, Proctor, Althea – PRO, Rees, Lloyd – REE, Roberts, Thomas William – RBT, Russell, John Peter – RUS, Smart, Frank Jeffrey – SMA, Smith, Grace Cossington – SMI, Streeton, Arthur – STR, Tucker, Albert – TUC, Whiteley, Brett – WHI, Williams, Frederick – WIL, Withers, Walter – WTH

FIGURE 1
Market risk and return by artist

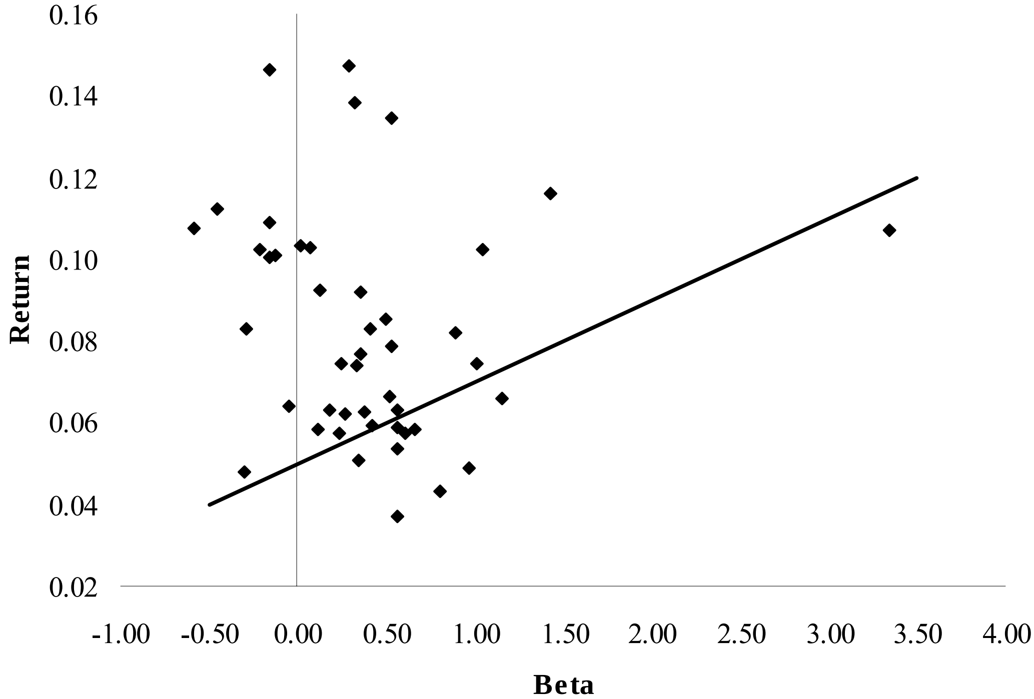

FIGURE 2
Mean price and return by artist